Parallel Computing

Parallel Computers

Today's Objectives

1st: You will understand what kind of computer most people use every day.

2nd: You will know what a parallel computer is and how it is different from a normal computer.

3rd: You will be able to differentiate between 2 kinds of parallel computers.

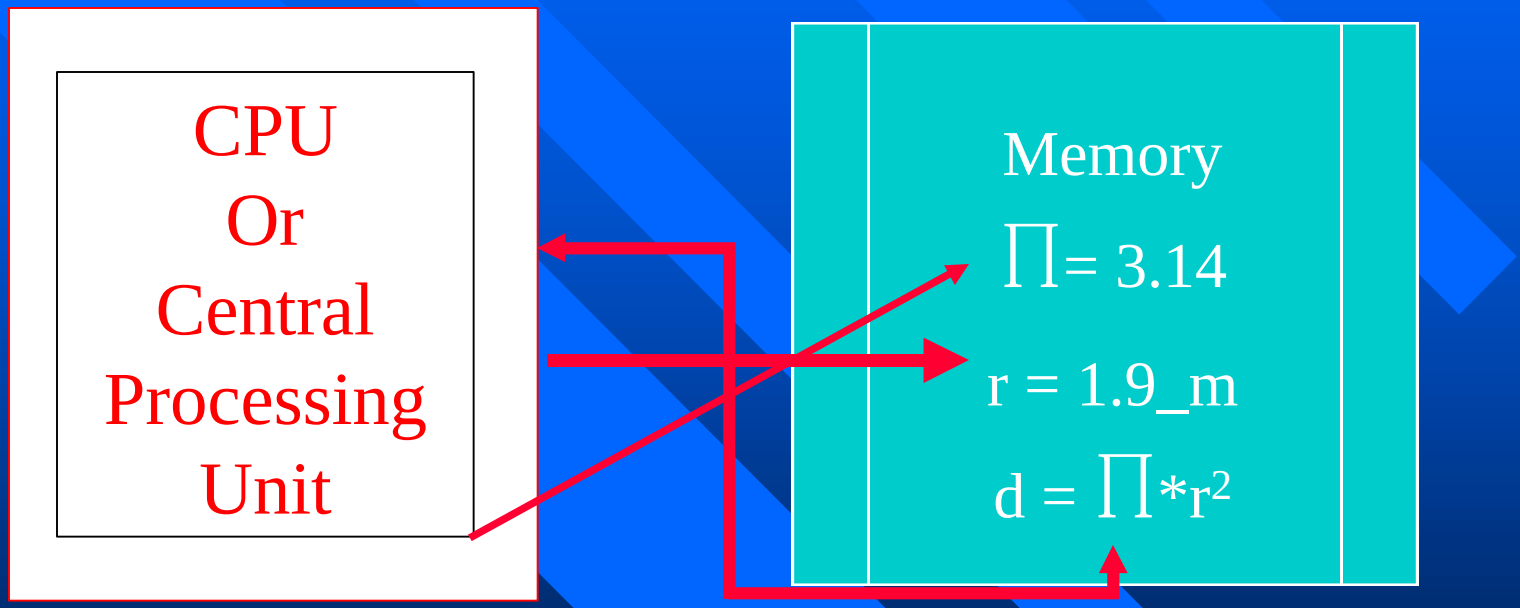
4th: You will develop the concept of a virtual computer.

Objective #1:You will understand what kind of computer most people use every day.

I. Most computers are examples of a von Neumann computer.

A. The von Neumann computer comprises a central processing unit (CPU) connected to a storage unit (memory).

Objective #1:You will understand what kind of computer most people use every day.



1. One CPU executes a program that performs a sequence of read and write operations on an attached memory

2nd Objective:You will know what a Parallel computer is and how it is different from a normal computer.

II. Parallel or Multiple Computers

A. These are a lot of von Neumann computers, linked by a network.

B. Each computer executes its own program.

2nd Objective:You will know what a Parallel computer is and how it is different from a normal computer.

II. Parallel or Multiple Computers

C. This program accesses its own memory and may send and receive messages over the network.

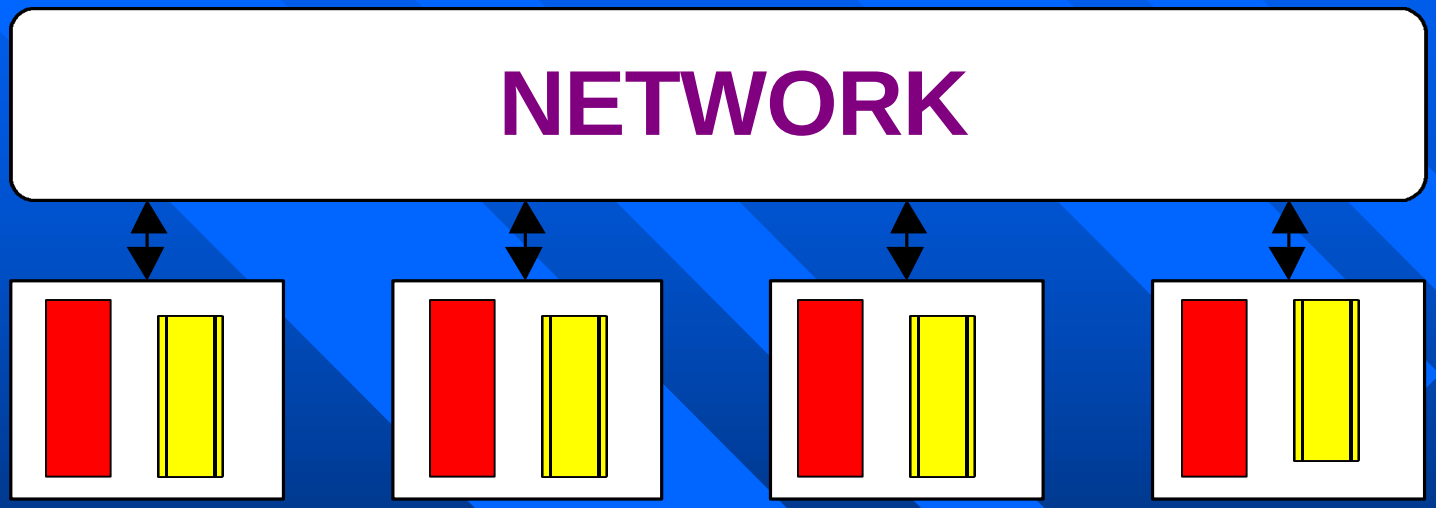
D. Messages are used to communicate with other computers and to read and write remote memories.

2nd Objective:You will know what a Parallel computer is and how it is different from a normal computer.

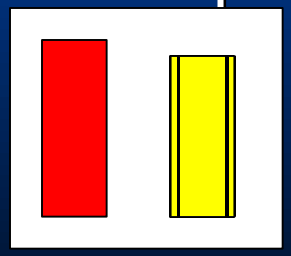
II. Parallel or Multiple Computers

E. The difference between a normal computer and a parallel computer is that a parallel computer contains a lot of von Neumann computers linked by a network.

2nd Objective:You will know what a Parallel computer is and how it is different from a normal computer.



1. An Example of Parallel or Multiple Computers

– Each  = 1 **von Neumann computer**

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

III. Two kinds of parallel computers

A. MIMD

1. This stands for multiple instruction and multiple data.

2. Each processor can execute a separate stream of instructions on its own data.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

A. MIMD

3. There are two kinds.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

3. There are two kinds.
    a. The first one is called a distributed memory MIMD.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

a. The first one is called a distributed memory MIMD.

    1. This means that memory is distributed among the processors, rather than placed in a central location.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

3. There are two kinds.

    b. The second one is called a multiprocessor or shared-memory MIMD.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

b. The second one is called a multiprocessor or shared-memory MIMD.

1. All of the processors share access to a common memory, typically via a bus or a hierarchy of buses.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

b. The second one is called a multiprocessor or shared-memory MIMD.

2. Shared memory implies that the access to it be controlled and in some predetermined order.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

2. Shared memory implies that the access to it be controlled and in some predetermined order.

   a. This enables a cache to be used with each processor.

   1. Access to cache is faster than access to the shared memory.

   2. This could speed the communication process up.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

III. Two kinds of parallel computers

B. ***SIMD***

1. This stands for single instruction multiple data.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

B. ***SIMD***

2. This means that all of the processors execute the same instruction stream on a different piece of data.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

B. ***SIMD***

3. These computers have noteworthy advantages and disadvantages.

3rd Objective:You will be able to differentiate between 2 kinds of parallel computers.

3. These computers have noteworthy advantages and disadvantages.

    a. The advantages are a reduced level of hardware and software complexity.

    b. The disadvantage is that all of them execute the same program.

4th Objective: You will develop the concept of a virtual computer.

IV. Virtual Computer

A. This focuses on the communication network used by these machines.

1. In super computers, Cray or IBM, these von Neumann computers are side by side.

a. The network is physically small in size.

4th Objective: You will develop the concept of a virtual computer.

A. This focuses on the communication network used by these machines.

2. Networks are not limited by physical dimensions.

4th Objective: You will develop the concept of a virtual computer.

2. Networks are not limited by physical dimensions.
   a. WAN or wide area network can cover the country or the world.
   b. LAN or local area network covers a building.

4th Objective: You will develop the concept of a virtual computer.

A. This focuses on the communication network used by these machines.

3. These networks enable us to view all of the computers as one multiple processor computer.

4th Objective: You will develop the concept of a virtual computer.

3. These networks enable us to view all of the computers as one multiple processor computer.
   a. Ethernet technology is very fast, cheap, and is very widespread.
      1. Think of home networking and the sharing of cable and DSL modems.

4th Objective: You will develop the concept of a virtual computer.

3. These networks enable us to view all of the computers as one multiple processor computer.

   b. Software that enables networking is now comes with every windows computer being produced and can be added to most other computer.

4th Objective: You will develop the concept of a virtual computer.

3. These networks enable us to view all of the computers as one multiple processor computer.

   c. All we need is software to put all of this together.

4th Objective: You will develop the concept of a virtual computer.

c. All we need is software to put all of this together.

1. There are many public and private solutions being developed now.

a. WINPAR, PVM, and Trapper are just a few.

b. Mathmatica has an add on package that enables without learning any additional computer languages.

4th Objective: You will develop the concept of a virtual computer.

c. All we need is software to put all of this together.

2. This new software enables any network to become a virtual supercomputer.

3. Most organizations do not have the resources to acquire a supercomputer but most do have networks.

A Brief Review

You should understand what kind of computer most people use every day.

You should know what a parallel computer is and how it is different from a normal computer.

You can differentiate between 2 kinds of parallel computers.

You now have a concept of what virtual computer .

Coming Attractions

MIMD Activity

SIMD Activity

The End

Science is everything we understand
well enough to explain to a computer.
Art is everything else.
---David Knuth